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(54) **EXHAUST SYSTEM THERMAL ENCLOSURE**

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F01N 3/025	(2006.01)
F01N 3/035	(2006.01)
F01N 3/20	(2006.01)
F01N 13/10	(2010.01)
F01N 13/14	(2010.01)

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CPC ***F01N 3/10*** (2013.01); ***F01N 3/025*** (2013.01); ***F01N 3/035*** (2013.01); ***F01N 3/2066*** (2013.01); *F01N 13/102* (2013.01); *F01N 13/14* (2013.01); *Y02T 10/24* (2013.01)

(58) **Field of Classification Search**

USPC 60/274–324

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,706,535	A *	12/1972	Taylor et al.	422/105
3,935,705	A *	2/1976	Hergoualch	60/302
4,086,976	A	5/1978	Holm et al.	
4,264,344	A	4/1981	Ludecke et al.	
4,349,078	A *	9/1982	Shimada et al.	180/69.1
4,419,113	A	12/1983	Smith	
4,502,278	A	3/1985	Stark	
4,548,164	A *	10/1985	Ylonen et al.	123/2
4,571,938	A	2/1986	Sakurai	
4,573,317	A	3/1986	Ludecke	
4,651,524	A	3/1987	Brighton	
4,987,738	A	1/1991	Lopez-Crevillen et al.	
5,243,819	A	9/1993	Woerner et al.	
5,572,866	A *	11/1996	Loving	60/274
5,865,618	A	2/1999	Hiebert	
6,543,562	B1 *	4/2003	Repko et al.	180/68.1
6,729,127	B2	5/2004	Woerner et al.	
6,834,634	B2 *	12/2004	Lawrence	123/195 C
6,938,614	B2	9/2005	Criddle et al.	
6,983,728	B1	1/2006	Banks, Jr. et al.	
6,990,804	B2	1/2006	Jacob et al.	
7,025,810	B2 *	4/2006	Crawley et al.	95/278

(Continued)

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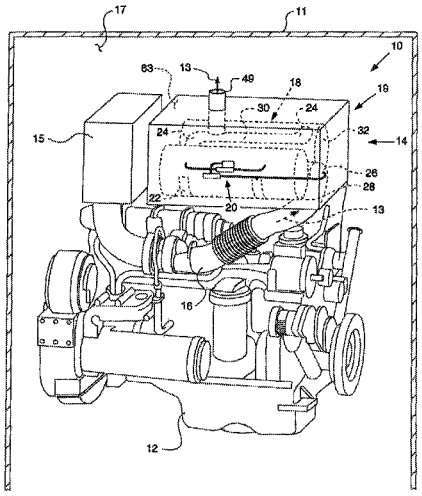
(57) **ABSTRACT**

An exhaust system for a power system contained in an engine compartment. The exhaust system includes a mount for two or more exhaust treatment devices and an enclosure surrounding the two or more exhaust treatment devices. The enclosure defines a space with a higher temperature than a space defined by the engine compartment during steady state operation of the power system. At least one electronic or fluid device is coupled to the enclosure or mount and located on an exterior of the enclosure.

22 Claims, 5 Drawing Sheets



(56) **References Cited**

U.S. PATENT DOCUMENTS

7,127,884	B2 *	10/2006	Worner et al.	60/299
7,193,333	B1 *	3/2007	Kitch	290/1 A
7,273,592	B2	9/2007	Jacob et al.	
7,779,624	B2	8/2010	Belisle et al.	
7,849,680	B2 *	12/2010	Shaff et al.	60/295
7,861,822	B2	1/2011	Redmann	
8,191,668	B2	6/2012	Keane et al.	
8,201,398	B2 *	6/2012	Boeckenhoff	60/301
8,707,687	B2 *	4/2014	Aneja et al.	60/295
2003/0221424	A1 *	12/2003	Woerner et al.	60/297
2004/0169374	A1	9/2004	Wurtele et al.	
2005/0048348	A1 *	3/2005	Bazzarella	429/34
2005/0056008	A1	3/2005	Endo	
2006/0266022	A1 *	11/2006	Woerner et al.	60/295
2007/0144126	A1	6/2007	Ohya et al.	
2008/0060351	A1	3/2008	Pawson et al.	
2008/0121451	A1 *	5/2008	Kertz et al.	180/69.24
2008/0173007	A1	7/2008	Imes	
2008/0314033	A1 *	12/2008	Aneja et al.	60/297
2009/0293452	A1	12/2009	Tarabulski	
2009/0313979	A1	12/2009	Kowada	
2010/0095660	A1	4/2010	Oliver et al.	
2010/0112878	A1	5/2010	White et al.	
2011/0023452	A1	2/2011	Gisslen et al.	
2011/0030353	A1	2/2011	Kamiya et al.	

* cited by examiner

FIG. 1

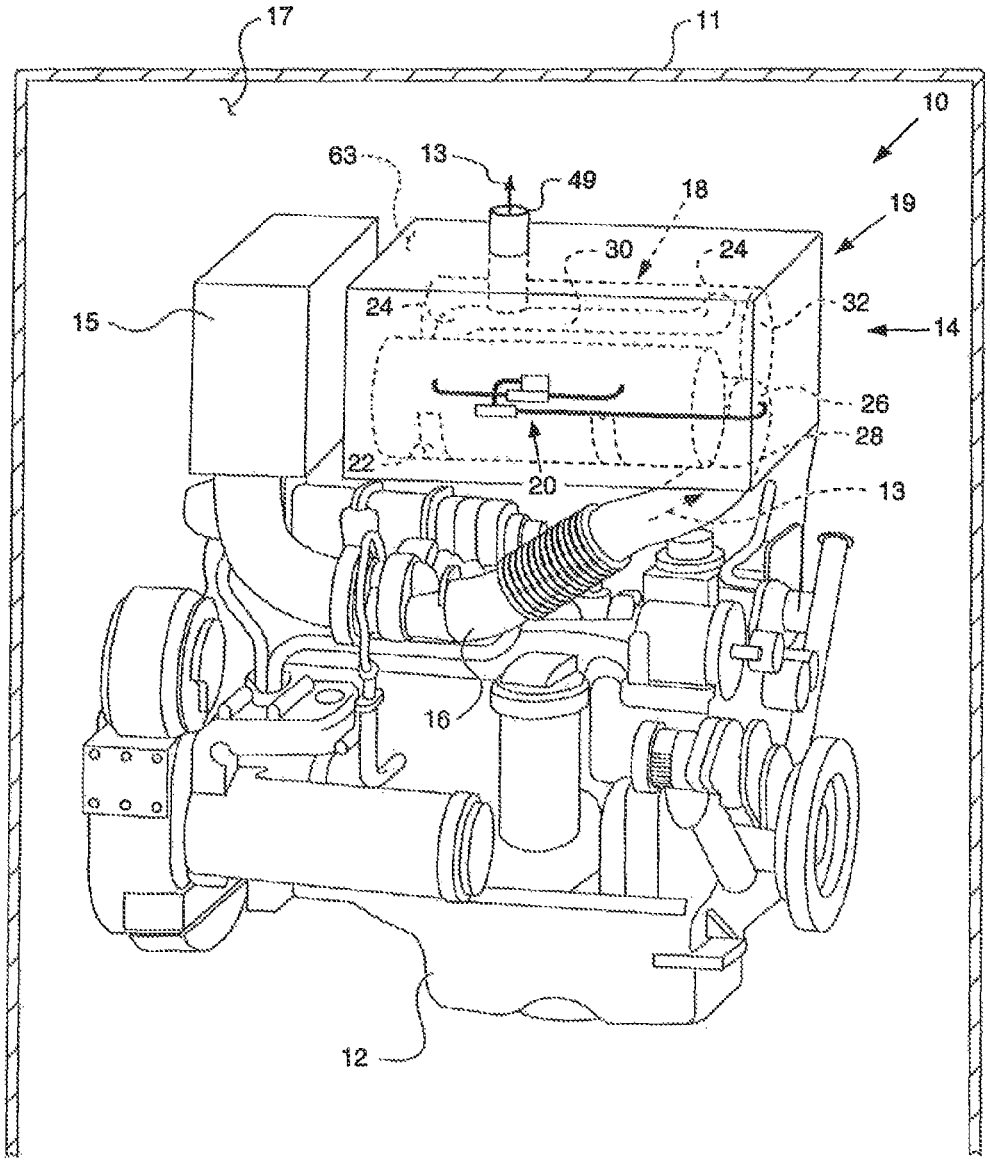
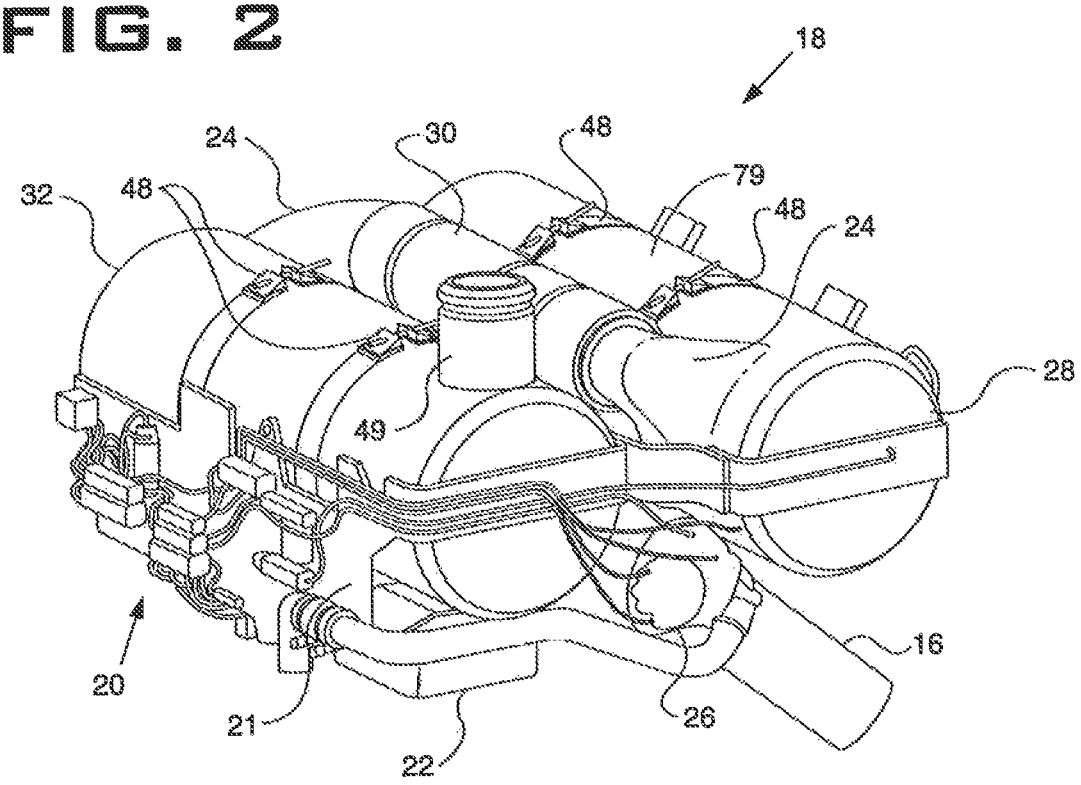


FIG. 2


18
24
30
48
32
48
79
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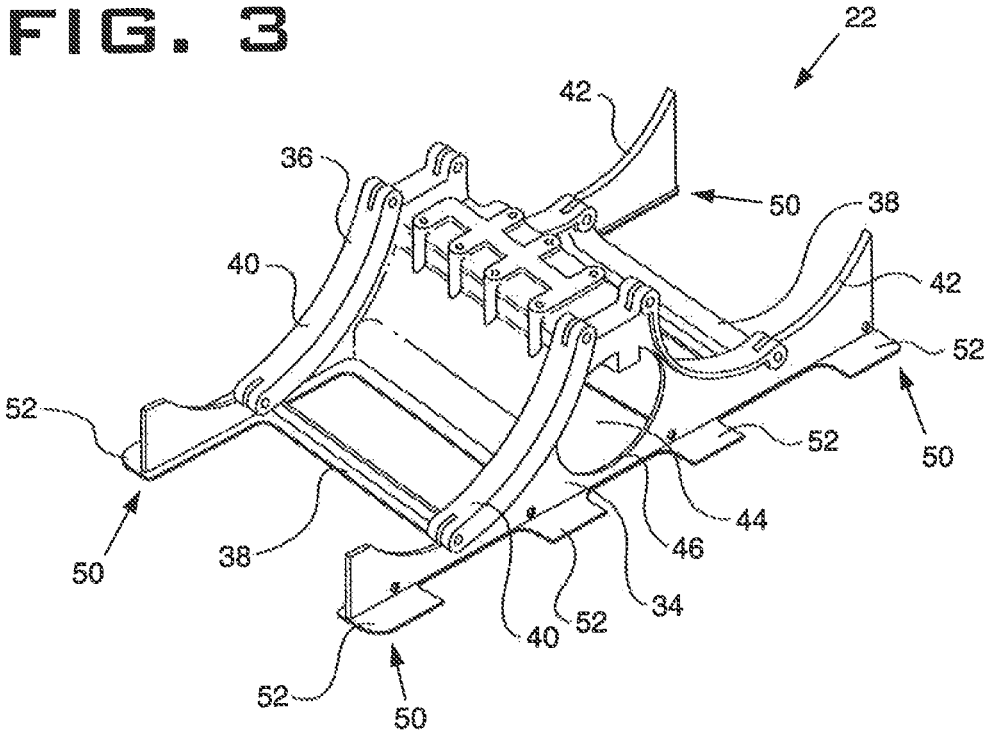
28
49
16
20
21
22
26

FIG. 3


22
42
36
50
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52
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44
46
34
40
52
52
50

FIG. 4

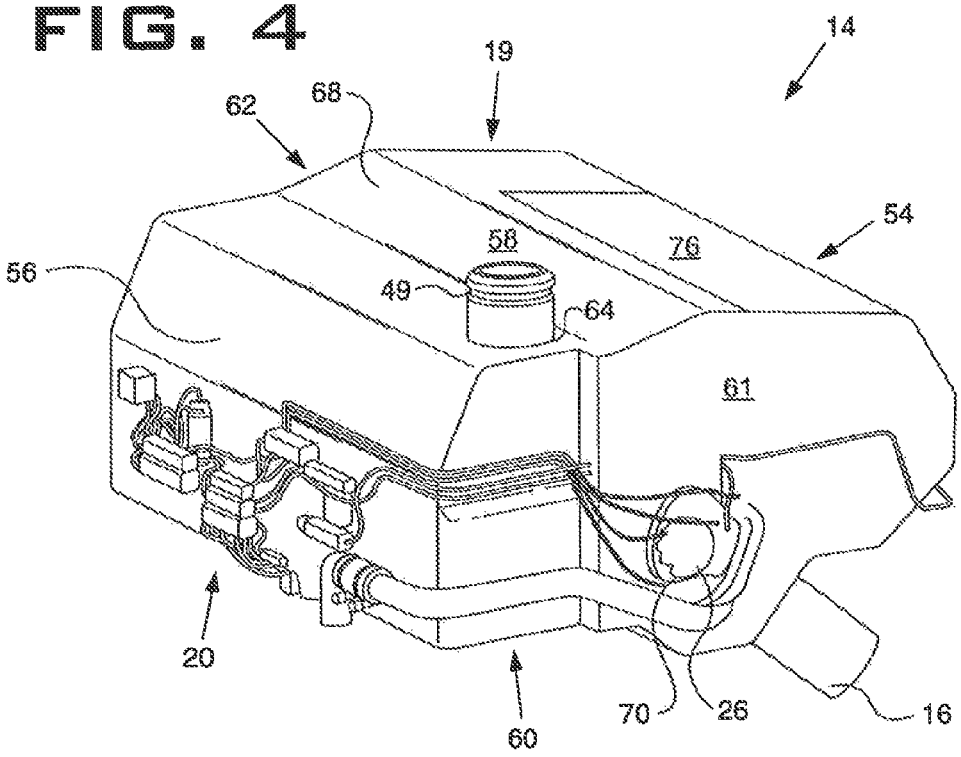
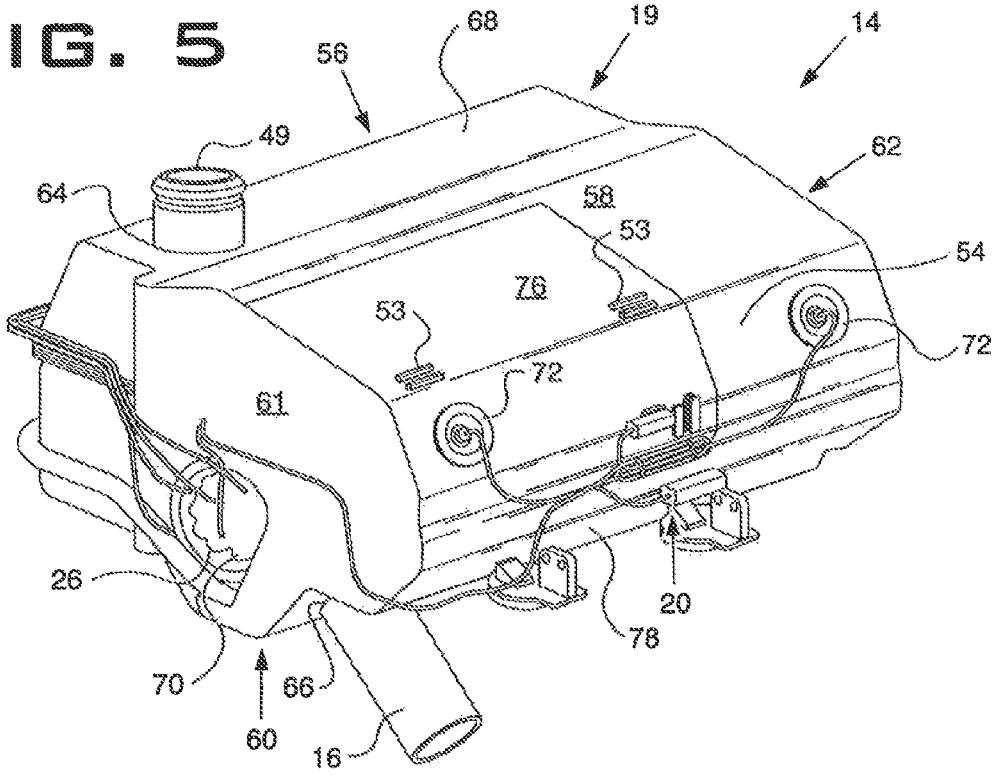

14
19
62
68
54
56
58
76
49
64
61
20
60
70
26
16

FIG. 5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19
68
56
49
62
64
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53
54
76
53
72
72
61
26
20
78
70
66
60
16

FIG. 6

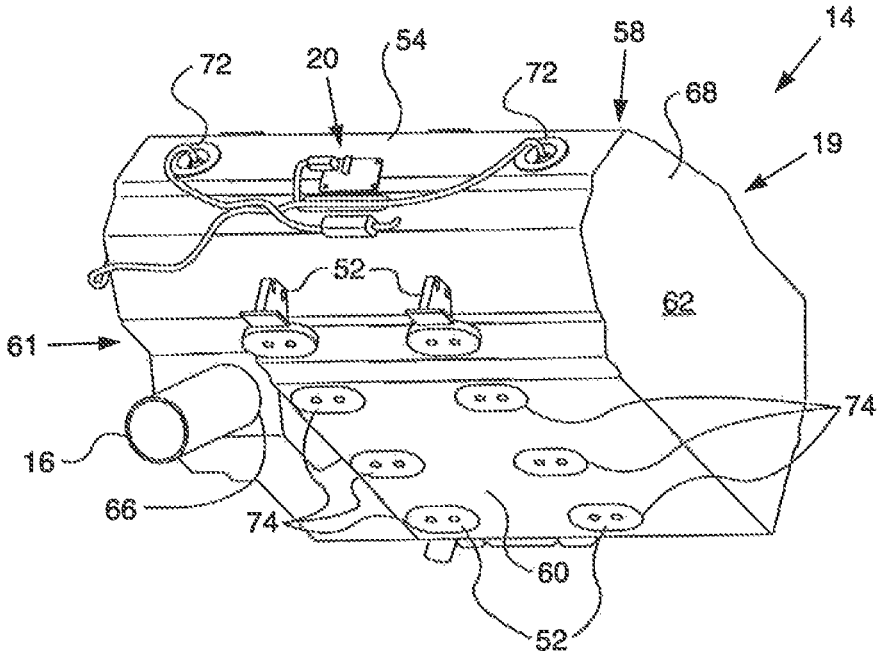

14
58
54
20
72
72
68
19
52
62
61
74
16
66
74
60
52

FIG. 7

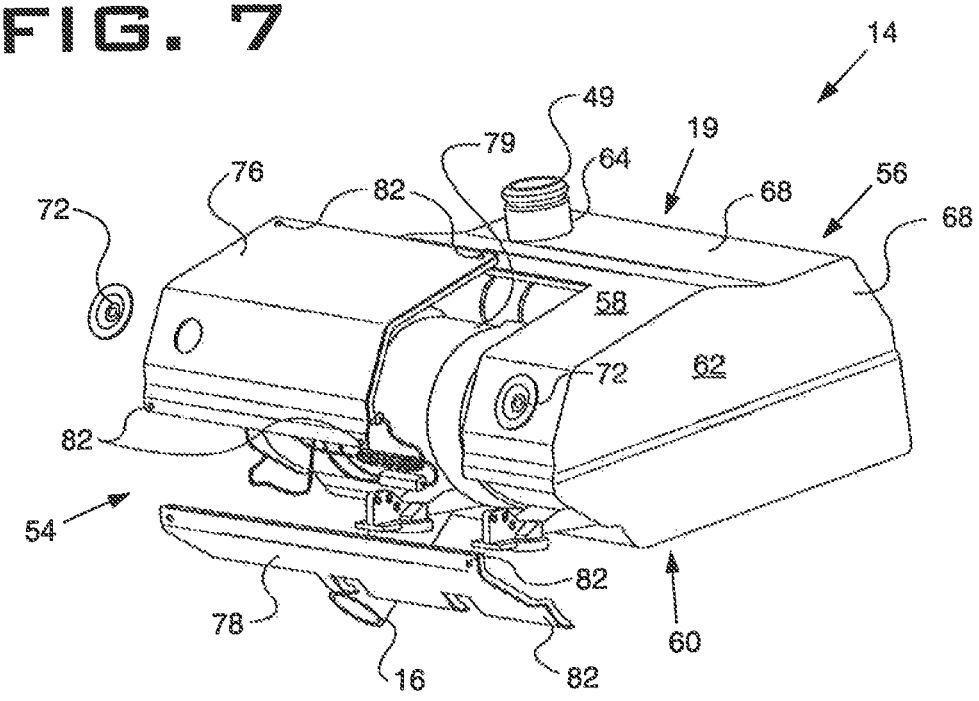

14
49
19
79
64
76
82
56
72
68
68
58
72
62
82
54
82
78
60
16
82

FIG. 8

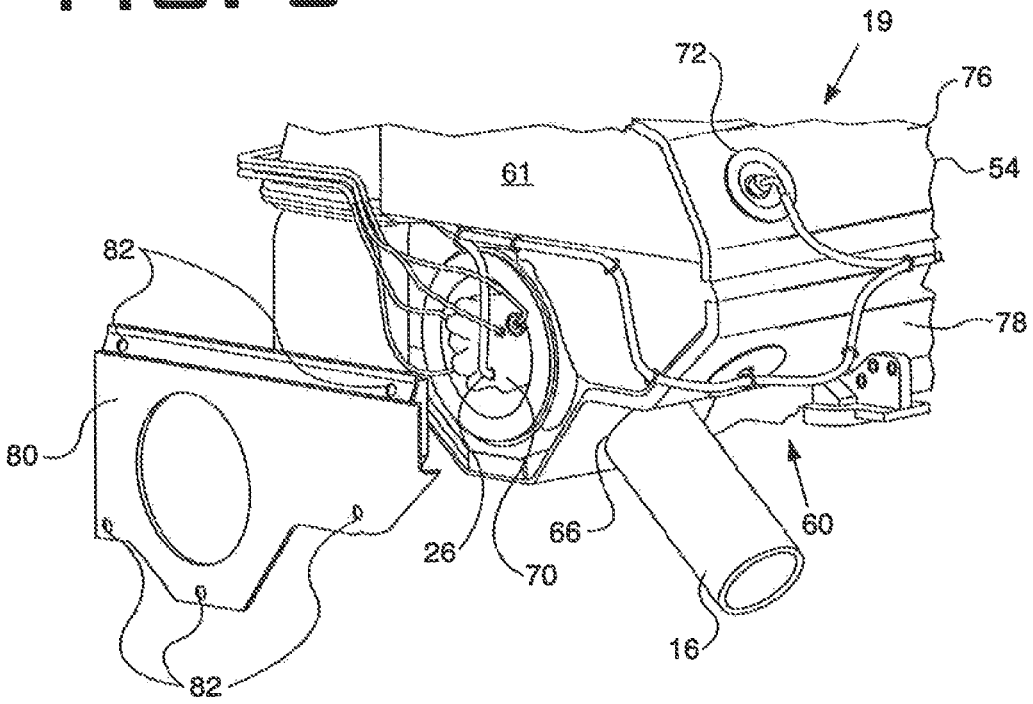
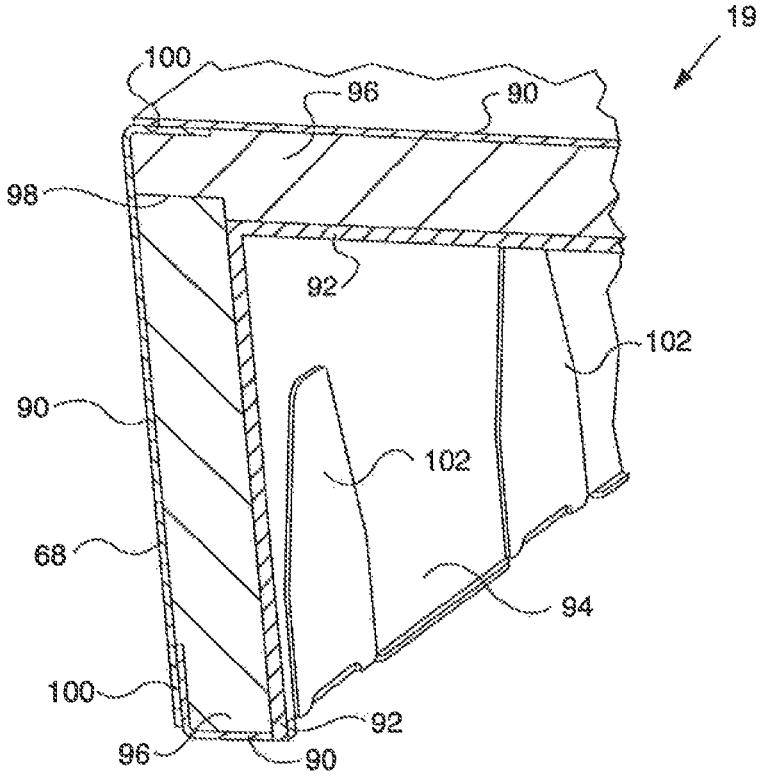

19
72
76
54
61
82
78
80
60
66
26
70
16
82

FIG. 9


19
100
96
90
98
92
102
90
102
68
94
100
92
96
90

EXHAUST SYSTEM THERMAL ENCLOSURE

This is a divisional of U.S. application Ser. No. 12/320,426, filed Jan. 26, 2009 and entitled "EXHAUST SYSTEM THERMAL ENCLOSURE" (PENDING), the entire disclosure of which is incorporated herein by reference.

TECHNICAL FIELD

The present disclosure relates generally to an enclosure for emissions system components and, more particularly, to a thermally insulating enclosure.

BACKGROUND

Conventional power systems for engines, factories, and power plants produce emissions that contain a variety of pollutants. These pollutants may include, for example, particulate matter (e.g., soot), nitrogen oxides (NOx), and sulfur compounds. Due to heightened environmental concerns, engine exhaust emission standards have become increasingly stringent. In order to comply with emission standards, machine manufactures have developed and implemented a variety of exhaust treatment components to reduce pollutants in exhaust gas prior to the exhaust gas being released into the atmosphere.

The exhaust treatment components may include, for example, a diesel particulate filter, a selective catalytic reduction device, a diesel oxidation catalyst, a heat source for regeneration of the diesel particulate filter, a muffler, and other similar components. Packaging of these exhaust treatment components is difficult and is often particularly difficult given the temperatures or heat involved. The devises and environment surrounding these exhaust treatment components may not be able to withstand this heat.

U.S. Pat. No. 7,127,884 (the '884 patent) describes multiple catalytic converter elements in a housing. The housing includes a jacket with a double wall.

SUMMARY

In one aspect, the present disclosure provides an exhaust system for a power system contained in an engine compartment. The exhaust system includes a mount for two or more exhaust treatment devices and an enclosure surrounding the two or more exhaust treatment devices. In another aspect, the enclosure defines a space with a higher temperature than a space defined by the engine compartment during steady state operation of the power system. In yet another aspect, at least one electronic or fluid device is coupled to the enclosure or mount and located on an exterior of the enclosure.

Other features and aspects of this disclosure will be apparent from the following description and the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a diagrammatic view of a power system including an engine and an exhaust system in an enclosure;

FIG. **2** is a diagrammatic view of a module with the exhaust treatment devices on a mount;

FIG. **3** is a diagrammatic view of the mount to receive the exhaust treatment devices;

FIG. **4** is a diagrammatic view of the module in the enclosure;

FIG. **5** is a diagrammatic view of the enclosure from FIG. **4** rotated;

FIG. **6** is a diagrammatic view of the bottom of the enclosure from FIG. **4**;

FIG. **7** is a diagrammatic view of the enclosure from FIG. **4** with a top front panel, bottom front panel, and plug removed;

FIG. **8** is a diagrammatic view of a side of the enclosure from FIG. **4** with a side panel removed; and

FIG. **9** is a cross-sectional view of the enclosure.

DETAILED DESCRIPTION

As seen in FIG. **1**, a power system **10** is contained inside an engine compartment **11**. The power system **10** includes an engine **12** and an exhaust system **14** to treat an exhaust stream **13** produced by the engine **12**. Engine **12** may receive air from an air cleaner **15**. The exhaust stream **13** exits the engine **12** from an exhaust conduit **16** to enter the exhaust system **14**. The engine **12** may include other features not shown, such as fuel systems, air systems, cooling systems, peripheries, drivetrain components, turbochargers, etc. The engine **12** may be any type of engine (internal combustion, gas, diesel, gaseous fuel, natural gas, propane, etc.), may be of any size, with any number of cylinders, and in any configuration ("V," in-line, radial, etc.). The engine **12** may be used to power any machine or other device, including on-highway trucks or vehicles, off-highway trucks or machines, earth moving equipment, generators, aerospace applications, locomotive applications, marine applications, pumps, stationary equipment, or other engine powered applications.

The engine compartment **11** is the portion of the machine or other device that contains the power system **10**. The walls of the engine compartment **11** define a compartment interior space **17** inside, where the power system **10** is located. The engine compartment **11** may include the machine's hood and engine's enclosure. The engine compartment **11** may be open on one or more sides or may fully surround the power system **10**. The engine compartment **11** may house additional components in addition to the power system **10**. Portions of the power system **10** may also extend beyond the engine compartment **11**. The engine compartment **11** may also have one or more radiators or other heat exchangers included in its walls or otherwise located in or outside the engine compartment **11**.

The exhaust system **14** includes an aftertreatment or component module **18** and enclosure **19**. Seen best in FIG. **2**, the module **18** may include electronics and fluids **20**, plate **21**, cradle or mount **22**, conduits **24**, and first, second, third, and fourth exhaust treatment devices **26**, **28**, **30**, and **32**. The module **18** may be designed to hold more or less than four exhaust treatment devices **26**, **28**, **30**, and **32**.

Exhaust treatment devices **26**, **28**, **30**, and **32** may be devices configured to reduce emissions of harmful gasses, particulate matter, and/or noise emitted from engine **12**. Each exhaust treatment device **26**, **28**, **30**, and **32** may embody, for example, a diesel oxidation catalyst (DOC), a particulate filter (PF or DPF), a selective catalytic reduction (SCR) device, a lean NOx trap (LNT), a muffler, a DPF regeneration device, a reductant mixing device, connection tube, or any other exhaust treatment or handling device known in the art.

Electronics and fluids **20** may be configured to monitor and/or control operation of exhaust treatment devices **26**, **28**, **30**, and **32**. Electronics **20** may include one or more electronic devices, such as, for example, sensors, microprocessors, power supply circuitry, signal conditioning circuitry, actuator driving circuitry, and/or other types of electronics and circuitry known in the art. For example, electronics **20** may include a microprocessor and other data processing hardware

configured to control injection of a reductant into one of exhaust treatment devices **26**, **28**, **30**, and **32** (e.g., reductant for SCR or LNT). Electronics **20** may also include a microprocessor and other data processing hardware configured to control a regeneration process for one of exhaust treatment devices **26**, **28**, **30**, and **32** (e.g., regeneration of DPF). Fluids **20** may include combustion air, fuel, reductant or other fluid used by the exhaust treatment devices **26**, **28**, **30**, and **32**.

At least a portion of the electronics and fluids **20** may be installed on the plate **21**. The plate **21** may be positioned outside or inside the enclosure **19**. Portions of the electronics and fluids **20** may also be located inside or outside the enclosure **19**. The plate **21** may be coupled or mounted to the mount **22** or enclosure **19**.

As shown in FIG. **3**, mount **22** is a device configured to support one or more exhaust treatment devices **26**, **28**, **30**, and **32**. Specifically, mount **22** may be configured to secure exhaust treatment devices **26**, **28**, **30**, and **32** in a compact configuration. Mount **22** may be designed to locate exhaust treatment devices **26**, **28**, **30**, and **32** in a parallel orientation relative to each other.

Mount **22** may include a first bracket **34** and a second bracket **36**. First bracket **34** and second bracket **36** may be oriented parallel but spaced apart from each other. First bracket **34** may be coupled to second bracket **36** using one or more rigid cross members **38**. Cross members **38** may attach to first and second brackets **34** and **36** via mechanical fasteners (e.g., bolts, screws, rivets, etc.), welding, brazing, or any other joining process known in the art. Alternatively, first bracket **34**, second bracket **36**, and cross members **38** may be formed as a single casting.

Each of first and second brackets **34** and **36** may include a first support surface **40**. First support surface **40** of first bracket **34** and first support surface **40** of second bracket **36** may be configured to support each end of fourth exhaust treatment device **32**. Each of first and second brackets **34** and **36** may also include a second support surface **42**. Second support surface **42** of first bracket **34** and second support surface **42** of second bracket **36** may be configured to support each end of second exhaust treatment device **28**. In addition to connecting first and second brackets **34** and **36**, one or more of cross members **38** may be configured to support a middle portion of fourth exhaust treatment device **32** and/or second exhaust treatment device **28**.

It is contemplated that a geometry of first support surface **40** may be shaped to match an outer geometry of fourth exhaust treatment device **32** and a geometry of second support surface **42** may be shaped to match an outer geometry of second exhaust treatment device **28**. For example, when fourth and second exhaust treatment devices **32** and **28** are shaped as canisters, first and second support surfaces **40** and **42** may have generally arcuate surfaces with substantially the same radii of curvature as fourth and second exhaust treatment devices **32** and **28**, respectively.

Mount **22** may also include an aperture **44** in first bracket **34** and second bracket **36**. Aperture **44** may define a third support surface **46**. Third support surface **46** of apertures **44** may be configured to support, for example, each end of first exhaust treatment device **26**. Exhaust treatment devices **26**, **28**, **30**, or **32** may be secured to the mount **22** via clamps, bolts, welding, or bands **48**. The exhaust treatment devices **26**, **28**, **30**, and **32** may be fluidly coupled together via conduits **24**. The exhaust stream **13** exits the module **18** through exit conduit **49**.

In the current exemplary embodiment, the second exhaust treatment device **28** may embody a DPF and the first exhaust treatment device **26** may embody a regeneration device for the DPF. This regeneration device may include a fuel fired burner or other heat source. The second exhaust treatment device **28** may also embody a DOC, possibly in addition to the DPF. The third exhaust treatment device **30** may embody a connection tube and the fourth exhaust treatment device **32** may embody a muffler. The fourth exhaust treatment device **32** may also embody an SCR device, and reductant may be injected and mixed in third exhaust treatment device **30**.

Mount **22** may include a base portion **50** with one or more mounting footings **52**. Each footing **52** may be configured to mount to the engine **12** or machine.

The enclosure **19** provides a degree of thermal isolation from the surrounding environment, devices, and electronics and fluids **20**. The enclosure **19** may be designed to minimize ventilation to achieve near total encapsulation. In one embodiment, however, vents **53** may be added to provide ventilation as needed for heat dissipation if the temperature inside the enclosure **19** would reach a limit.

The enclosure **19** may include a front **54**, a back **56**, a top **58**, a bottom **60**, a first side **61**, and a second side **62** to form a box structure. The enclosure **19** defines an enclosure interior space **63** inside, where the module **18** is located.

The exit conduit **49** may exit the enclosure **19** through an exit opening **64**. The exit opening **64** may be located in the top **58** of the enclosure **19** or elsewhere as needed to route the exhaust stream **13** to the atmosphere. The exhaust conduit **16** may enter the enclosure **19** through an entrance opening **66**. The entrance opening **66** may be located in the bottom **60** of the enclosure **19** or elsewhere as needed to route the exhaust stream **13** to the first exhaust treatment device **26**.

As seen in FIGS. **4** and **5**, the electronics and fluids **20** may be mounted or at least partially located on an outside or exterior **68** of the enclosure **19**. The electronics and fluids **20** may also be routed to run along the exterior **68**. A head portion **70** of the first exhaust treatment device **26** may be exposed by the enclosure **19**. The electronics and fluids **20** required for the first exhaust treatment device **26** may connect at this exposed head portion **70**, thereby avoiding the heat inside the enclosure **19**.

The electronics and fluids **20** may also enter the enclosure **19** through ports **72** or other openings. These electronics and fluids **20** may be used for sensing or introducing reductants. If included, the plate **21** may also be outside the enclosure **19** and may be coupled to the mount **22**.

FIG. **6** shows the enclosure **19** may include mount openings **74**. The mount openings **74** expose the footings **52** or another part of the base portion **50**, providing access for the exhaust system **14** to be mounted.

Portions or panels of the enclosure **19** may be removable to allow servicing of the module **18** and exhaust treatment devices **26**, **28**, **30**, and **32**. FIG. **7** shows a removable front top panel **76** and bottom front panel **78** to be removable from the other parts of the enclosure **19**. In one embodiment, the front top panel **76** and bottom front panel **78** are located to provide access to a DPF portion **79** of the second exhaust treatment device **28**. The DPF may have to be periodically removed for service. The front top panel **76** and bottom front panel **78** may provide access to the DPF or second exhaust treatment device **28**. The DPF portion **79** may be located between bands **48** so that the DPF portion is removable from the second exhaust treatment device **28** for service.

FIG. **7** also shows ports **72** may be removable. FIG. **8** shows a side panel **80** may also be removable to provide access to the regeneration device or first exhaust treatment device **26** and its associated electronics and fluids **20**. Other portions of the enclosure **19** may be removable as needed for

assembly and service. Any portion of the front **54**, back **56**, top **58**, bottom **60**, first side **61**, or second side **62** may be removable.

The removable panels may be held in place with fasteners **82**. The fasteners **82** may be bolts, 90 degree quick turn latches, clips, or other fastening device. The removable panels may rest on over hanging portions of the surrounding portions of the enclosure **19**. Support tabs may also be added for the removable panels to rest on and prevent from falling into the enclosure **19**.

Because access to the enclosure **19** may be limited in the machine, the removable panels may be designed so that they can be removed from a given direction for accessibility. Additionally, the fasteners **82** may be located so that they can be accessed from a given direction. This given direction may provide access from the top, bottom, front, back, or side. In one embodiment, for example, the front top panel **76** and bottom front panel **78** are removable and assessable from the front without access needed from the top.

FIG. **9** illustrates how the enclosure **19** may be constructed. An outer shell **90** may form the exterior **68**, an inner shell **92** may form an interior **94**. An insulation **96** may be between the outer shell **90** and inner shell **92**. An alternative embodiment may not include an outer shell **90** or inner shell **92** depending on the durability of the insulation **96**. The front **54**, back **56**, top **58**, bottom **60**, first side **61**, or second side **62** may overlap at overlapping regions **98** to form the enclosure **19** structure.

The outer shell **90** and inner shell **92** may be a material of composition and size to withstand the temperature and stress involved. In one embodiment, the outer shell **90** may be aluminized steel, sheet metal, or **321** or **316** corrosion resistant steel (CRS) and may be roughly 1.5 mm thick. The inner shell **92** may be a glass silica fiber or high efficiency paper based material and may have adhesive and may be roughly 12 mm thick and also serve as the insulation **96**.

The front **54**, back **56**, top **58**, bottom **60**, first side **61**, or second side **62** outer shells **90** may also include overlapping outer shell regions **100** to form the enclosure **19** structure. The outer shell **90** may also include containment clips **102**. The containment clips **102** may extend or fold over from the edge of the outer shell **90** and over the interior **94** to hold the inner shell **92** or insulation **96** in place. Alternative embodiments may include fasteners to hold the outer shell **90**, inner shell **92**, and insulation **96** in place.

The spacing between the enclosure **19** and module **18** may be designed to avoid direct contact while limited for packing in the machine. In one embodiment, the enclosure **19** is spaced roughly 1 inch from the module **18**. In other embodiments, the enclosure **19** may be in contact with the module **18** or spaced apart from the module **18** at a greater distance. The contour, shape, and size of enclosure **19** and module **18** may be designed to achieve the desired spacing.

INDUSTRIAL APPLICABILITY

Achieving a limited enclosure **19** exterior **68** temperature may be desired in certain machine application. For example, many machine applications are exposed to a variety of combustibles. Other machine applications may involve personnel near the power system **10**.

The design of the enclosure **19** is developed to achieve a given exterior **68** or skin temperature as required by the machine application during normal operation conditions of the power system **10**. In one embodiment, the design may be sufficient to achieve an exterior **68** temperature of roughly 200 degrees Celsius. This exterior **68** temperature may be achievable with a temperature of the exhaust stream **13** at the exit conduit **49** of roughly 550 degrees Celsius and a temperature surrounding the enclosure of 80 degrees Celsius.

The enclosure **19** insulates the module **18** from its surroundings. As such, during steady state operation of the power system **10**, the temperature in the enclosure interior space **63** is higher than the temperature in the compartment interior space **17**. Accordingly, the enclosure **19** protects the components located outside or exterior to the enclosure **19** from thermal damage. The limited exterior **68** temperatures and enclosure interior space **63** temperatures provided by the enclosure **19** may specifically protect the electronics and fluids **20**.

The steady state operation of the power system **10** may be considered the time when the temperature in the enclosure interior space **63** and compartment interior space **17** both reach a substantially maximum and constant temperature. The enclosure **19** may also acoustically insulate the module **18** from its surroundings.

Although the embodiments of this disclosure as described herein may be incorporated without departing from the scope of the following claims, it will be apparent to those skilled in the art that various modifications and variations can be made. Other embodiments will be apparent to those skilled in the art from consideration of the specification and practice of the disclosure. It is intended that the specification and examples be considered as exemplary only, with a true scope being indicated by the following claims and their equivalents.

What is claimed is:

1. A portion of an exhaust system for a power system contained in an engine compartment, comprising:

an exhaust treatment module including two or more exhaust treatment devices, one of the exhaust treatment devices including a fuel fired burner, and a module housing arrangement conveying exhaust from an inlet of the module to an outlet of the module;

an enclosure surrounding the exhaust treatment module, the enclosure being located in the engine compartment and forming an air gap between the module housing arrangement and the enclosure, the enclosure having an outer shell, an inner shell, and an insulation between the inner shell and the outer shell; and

an electronic device coupled to an exterior of the enclosure,

wherein exhaust is only in fluid communication with the exhaust treatment module in the portion of the exhaust system, and

wherein the enclosure has at least one gap such that a portion of the exhaust treatment module is exposed to the exterior of the enclosure.

2. The exhaust system of claim **1**, wherein the electronic device connects to one of the two or more exhaust treatment devices.

3. The exhaust system of claim **1**, wherein one of the two or more exhaust treatment devices includes a diesel particulate filter.

4. The exhaust system portion of claim **1**, wherein the enclosure includes at least one removable panel to provide access to at least one of the two or more exhaust treatment devices.

5. The exhaust system portion of claim **1**, further including a mount that supports the two or more exhaust treatment devices.

6. The exhaust system portion of claim **1**, further including a fluid device coupled to the exterior of the enclosure.

7. The exhaust system portion of claim **1**, wherein the mount includes a first bracket and a second bracket.

8. The exhaust system portion of claim **7**, wherein the first and second brackets are substantially parallel to each other.

9. The exhaust system portion of claim 1, wherein the at least one gap is configured to allow the electronic device to connect to one of the two or more exhaust treatment devices.

10. The exhaust system portion of claim 5, wherein the at least one gap is configured to allow the mount to support the two or more exhaust treatment devices.

11. A portion of an exhaust system for a power system contained in an engine compartment, comprising:

an exhaust treatment module including two or more exhaust treatment devices and a module housing arrangement having a module exhaust inlet conduit and a module exhaust outlet conduit; and

an enclosure surrounding the exhaust treatment module, the enclosure

being located in the engine compartment adjacent an engine of the power system,

forming an air gap between the module housing arrangement and the enclosure,

including a first opening surrounding the module exhaust inlet conduit, and a second opening surrounding the module exhaust outlet conduit, and

including an outer shell, an inner shell, and an insulation between the inner shell and the outer shell; and

an electronic device coupled an exterior of the enclosure,

wherein exhaust is only in fluid communication with the exhaust treatment module in the portion of the exhaust system, and

wherein the enclosure has at least one gap such that a portion of the exhaust treatment module is exposed to the exterior of the enclosure.

12. The exhaust system portion of claim 11, wherein the enclosure includes at least one removable panel to provide access to at least one of the two or more exhaust treatment devices.

13. The exhaust system portion of claim 12, wherein the enclosure includes at least a front, a back, a top, a bottom, a first side, and a second side to form a box structure.

14. The exhaust system portion of claim 13, wherein one of the exhaust treatment devices includes a diesel particulate filter and one of the exhaust treatment devices includes a fuel fired burner.

15. The exhaust system portion of claim 14, wherein the exhaust treatment module further includes a diesel oxidation catalyst (DOC).

16. The exhaust system portion of claim 11, further including a fluid device coupled to the exterior of the enclosure.

17. The exhaust system portion of claim 11, wherein the mount includes a first bracket and a second bracket.

18. The exhaust system portion of claim 17, wherein the first and second brackets are substantially parallel to each other.

19. A portion of an exhaust system for a power system contained in an engine compartment, comprising:

an exhaust treatment module including two or more exhaust treatment devices and a module housing arrangement conveying exhaust from an inlet of the module to an outlet of the module;

an enclosure surrounding the exhaust treatment module, the enclosure being located in the engine compartment and forming an air gap between the module housing arrangement and the enclosure;

an electronic device coupled to an exterior of the enclosure; and

a fluid device coupled to the exterior of the enclosure,

wherein exhaust is only in fluid communication with the exhaust treatment module in the portion of the exhaust system, and

wherein the enclosure has at least one gap such that a portion of the exhaust treatment module is exposed to the exterior of the enclosure.

20. The exhaust system portion of claim 19, wherein the electronic device or the fluid device connects to one of the two or more exhaust treatment devices.

21. The exhaust system portion of claim 19, wherein the mount includes a first bracket and a second bracket.

22. The exhaust system portion of claim 21, wherein the first and second brackets are substantially parallel to each other.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 9,103,254 B2
APPLICATION NO. : 13/842390
DATED : August 11, 2015
INVENTOR(S) : Merchant et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the specification

Column 1, line 2, below 'Title' insert -- CROSS-REFERENCE TO RELATED APPLICATION --.

In the claims

Column 6, line 49, claim 2, delete "The exhaust system of claim 1," and insert -- The exhaust system portion of claim 1, --.

Column 6, line 52, claim 3, delete "The exhaust system of claim 1," and insert -- The exhaust system portion of claim 1, --.

Column 7, line 23, claim 11, delete "coupled an" and insert -- coupled to an --.

Signed and Sealed this
Twenty-fifth Day of October, 2016

Michelle K. Lee

Michelle K. Lee
Director of the United States Patent and Trademark Office